



NASA STTR 2012 Phase I Solicitation

T6 Human Health, Life Support and Habitation Systems

Human Health, Life Support and Habitation Systems, includes technologies necessary for supporting human health and survival during space exploration missions and consists of five technology subareas: environmental control and life support systems and habitation systems; extravehicular activity systems; human health and performance; environmental monitoring, safety, and emergency response; and radiation. These missions can be short suborbital missions, extended microgravity missions, or missions to various destinations, and they experience what can generally be referred to as "extreme environments" including reduced gravity, high radiation and UV exposure, reduced pressures, and micrometeoroids and/or orbital debris.

Subtopics

T6.01 Space Synthetic Biology and Food Production Technologies for Space Exploration

Lead Center: ARC

Participating Center(s): JSC, KSC

Space Synthetic Biology: Synthetic Biology (SB) provides a unique opportunity to design organisms that reliably perform necessary functions for future exploration activities. NASA is interested in harnessing this emerging field to create technological advances that will benefit both spaceflight and future surface missions in a variety of enabling areas. Of particular interest is the use of SB, including bioelectrical systems/organisms and technologies, that will reduce the required up-mass and dependence on consumables, resupply, and energy. This may be done through in situ resource utilization (ISRU) and/or the development of more sustainable and efficient systems. Specifically, ISRU technologies should address how SB-based systems may use in situ resources (e.g., regolith, CO₂) to fabricate advanced materials and/or produce building materials, fuels and plastics. SB-based food production is another area of interest. SB based Environmental Control and Life Support Systems (ECLSS) should focus on increasing efficiency/reliability/regenerability of air, water and waste management. Prototype hardware to support SB-based systems and modified cell lines - (particularly BES) with potential application for ISRU, ECLSS and food production would all be of interest to NASA. A prototype DNA "writer" technology for transmitting new DNA sequences to SB systems would be considered an enabling technology.

Food Production Technologies for Space Exploration: NASA is interested in food production and related food safety technologies for both near term transit (μ -gravity) missions and eventual surface missions (fractional gravity).

Of special interest is the use of plants (e.g., crops) to photosynthetically produce food, and contribute to cabin O₂ production and CO₂ removal. Food production technologies should address how quantum and/or radiation use efficiency will be improved to reduce energy costs, including advanced lighting concepts. Improved concepts for gravity independent watering techniques will also be needed. Complementary approaches might consider selecting or adapting the plants for optimal performance for the constraints of space environments, which could include smaller growing volumes, micro to fractional g, elevated radiation, super-elevated CO₂ concentrations (e.g., >5000 ppm or 0.5 kPa), and narrow band light spectra. Related technologies for sanitizing or reducing the microbial loads to reduce the safety risks of preparing and consuming space grown foods are also needed. All systems should consider minimizing power, mass, consumables, and biologically produced waste, while maximizing reliability and efficiency.